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PORTABLE DEBARKING AND CHIPPING MACHINES CAN IMPROVE FORESTRY PRACTICES[1]

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ABSTRACT

Use of portable debarking and chipping machines may be a suitable means of disposing of thinnings, defective overmature trees, and logging residues. Trial chipping under five different field conditions produced chips suitable for pulping. Chip output per day varied considerably, depending upon the size of the average piece, stand volume per acre, and upon skidding conditions.

Among the problems facing foresters of the Inland Empire is the utilization of excess trees removed by thinning, defective overmature trees, and logging residue.

In the northern Rocky Mountain region, it has been estimated that approximately three and a half million acres of National Forest land and an additional one million acres of private land are in need of thinning if the area's growth potential is to be attained. These stands are primarily western larch, lodgepole pine, grand fir, hemlock, ponderosa pine, and Douglas-fir. Generally, stands are between 20 and 70 years old; trees average about 7 inches in diameter.

Overmature stands often contain a large amount of heart rot and other defective material. Stands of this type--primarily grand fir and hemlock--occupy between 500,000 and one million acres in Montana and Idaho.

After the timber has been harvested, short log sections, tops, and defective logs are left scattered over the ground. In addition, there are usually a few small standing trees. This material either is bulldozed into piles and burned or the area is cleared of standing trees and broadcast burned to prepare the site for planting or natural regeneration. It was estimated in 1962 that there was approximately 75 million board feet[3] of logging residue in the northern Rocky Mountain region.

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[1] The authors are indebted to the Anaconda Forest Products and the Hoerner-Waldorf Companies for providing much of the information contained in this report.

[2] Marketing analyst and wood technologist, respectively, stationed at the Forestry Sciences Laboratory in Missoula, Montana, which is maintained in cooperation with the University of Montana.

[3] U.S. Forest Service. Timber trends in the United States. 235 p. Forest Resource Rep. 17. Wash., D.C., U.S. Govt. Printing Office. 1965.

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If equipment and procedures could be developed to utilize the material described above, foresters would be able to recover some of these wood values. Less waste on the ground would reduce the fire hazard. Better utilization also would eliminate or minimize the use of fire for slash disposal and so help to maintain satisfactory air quality.

Portable debarking and chipping machines, which might be a partial solution to the problems discussed above, may be developed into more suitable tools in the future. This paper reports on a trial study of commercially available machines used on five areas in western Montana.

PROCEDURE

Portable debarking and chipping machines were operated in tandem throughout this trial. Both pieces of equipment were mounted on separate trailers towed by a chip truck.

The debarker has a Rosser-type debarking head and a variable feed (maximum rate, 125 feet per minute). A 125-horsepower diesel engine drives the debarker head and the hydraulic pump that powers conveyors, outriggers, and loading arms. The infeed conveyor has four groundline loading arms on each side that lift logs onto the infeed conveyor. Barked material is fed directly onto the chipper infeed. The debarker can handle logs 22 inches in diameter and 50 feet in length.

The chipping unit uses a 280-horsepower diesel engine for power. Infeed rate (to 120 feet per minute) is automatically controlled by the chipper disk rotation speed. Chips are blown directly from the discharge side of the chipper into a chip trailer. One man controls the entire debarking-chipping operation.

In order to determine chip recovery under different topographic and stand conditions, the debarker and the chipper were used on five areas. Each of the areas selected was considered a typical example of different utilization opportunities in the region.

Trees were felled and limbed before the debarking and chipping machines were brought to the area. Tree or log lengths then were skidded directly to the groundline lift arms of the debarker's infeed conveyor.

AREA DESCRIPTIONS

Area I.--This 22.4-acre stand of young second-growth ponderosa pine on relatively flat ground was thinned to 110 trees per acre and yielded 2.7 cords[4] per acre.

Area II.--This 25-acre area was logged in 1966 and prepared for broadcast burning. However, plans for the burning were not carried out. About 5 cords per acre were recovered from the logging residue.

Area III.--This area consists of approximately 6 acres in a creek bottom. The stand was primarily overmature grand fir and Engelmann spruce. All dead and cull (defective) material was used. About 36 cords per acre were recovered from this area.

Area IV.--This area consisted of approximately 10 acres located near a ridgetop. The mixed stand (Douglas-fir, western larch, and lodgepole pine) had been selectively cut earlier. The residual stand was thinned while the debarker and the chipper were in the area. Approximately 11 cords per acre were recovered by thinning.

Area V.--Here, a relatively dense 6.0-acre stand of pole-sized lodgepole pine on fairly level ground was clearcut. About 24.5 cords per acre were recovered from the area. Data for the five areas are shown in table 1.

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[4]One cord of roundwood equals 85 feet or one 2,400-pound bone-dry chip unit.

Table 1.--Log and stand data for the five areas used in the trial study of portable debarking and chipping machines

Area no.	Species	Type of cut	Cords per acre removed	Total cords removed[1]	Average mid-diameter	Average cubic feet per piece
					Inches	
I	Ponderosa pine	Thinning	2.67	59.75	5.5	4.0
II	Western larch and Douglas-fir	Salvage	4.97	124.25	6.6	5.8
III	Grand fir and Engelmann spruce	Salvage	35.93	215.60	9.8	15.3
IV	Western larch, Douglas-fir, lodgepole pine	Thinning	10.82	108.20	7.4	9.8
V	Lodgepole pine	Clearcut	24.33	146.00	5.9	5.9

[1]One cord of roundwood equals 85 feet or one 2,400-pound bone-dry chip unit.

RESULTS AND DISCUSSION

Chips produced by the portable chipper were satisfactory for pulping. No screening was necessary.

Results of this trial are shown in table 2. Area I had the smallest amount of wood (59.75 cords) recovered and the lowest daily production (23.9 cords). Low chip production was a reflection of skidding distances and small-piece size (average 4.0 cubic feet). Perhaps the most efficient way to process material from similar areas would be to deck logs before moving the debarking and chipping machines to the location.

Area II produced a total of about 124 cords in 3.5 days, an average of 35.5 cords per day. Material in this area also was relatively small, averaging 5.8 cubic feet. However, daily chip production was greater than that of Area I, although a larger acreage was covered--25 acres compared with Area I's 22.4 acres. The area was roaded during logging operations; so higher production can be attributed to better skidding conditions. This area's production rate would have been even greater if the material had been decked before the debarker and chipper were brought in.

Area III produced a total of 215.6 cords in 3.5 days. Improved chip production resulted primarily from a decrease in skidding distances over an area less than 6 acres in size and from the larger cubic volume per piece.

Area IV produced a total of about 108 cords in 2 days, an average daily production of approximately 54 cords. This production rate was less than that of Area III, because the area was larger and the material smaller.

Area V produced a total volume of about 146 cords in 4 days. Daily production of the debarking and chipping machines was affected mainly by material size, since the area included only 6 acres.

High daily production depends to a large extent on the volume of chipping material per acre. If the volume is relatively high, the material should be skidded into place and fed directly to the machines (hot logging). If, on the other hand, the volume is relatively low, the material should be skidded and decked before the machines are moved into the area (cold decking).

Table 2.--Results of debarker-chipper trial on five different areas

Area no.	Cords per acre removed	Total cords removed[1]	Days operated	Cords per day[1]	No. pieces per cord	Dry weight percent[2]
I	2.67	59.75	2.5	23.9	21.2	46.3
II	4.97	124.25	3.5	35.5	14.7	81.8
III	35.93	215.60	3.5	61.6	5.6	71.5
IV	10.82	108.20	2.0	54.1	8.7	67.8
V	24.33	146.00	4.0	36.5	114.4	55.7

[1]One cord of roundwood equals 85 feet or one 2,400-pound bone-dry chip unit.
[2]The ovendried weight per unit of chips expressed as a percent of the green weight.

Forest management practices have become more intensified in recent years to take advantage of basic land productivity. Thinning and salvage operations to improve the growth rates of residual stands are more commonplace. In the northern Rocky Mountain region, 20,000 to 30,000 acres are thinned each year at an average cost of about $36 per acre. Any net sum realized from chip sales would reduce the cost of thinning operations. Consequently, more acres could be thinned for the same fixed appropriation.

The burning of logging slash has two disadvantages: (1)fire can get out of control, an infrequent but costly occurrence; and (2)the burning of slash contributes to air pollution. When use of the debarker and the chipper is feasible, less burning of logging residue is necessary. In the northern Rocky Mountain region, the cost of burning averages about $20 per acre; so chipping (even if it were a negative-value operation) would cost less than burning.

In addition, debarking and chipping operations indirectly benefit forest soils. Plant nutrients are added to such soils when logging debris, unsuitable for chipping, is packed to the ground for more rapid decomposition, or when skidding exposes rich, mineral soil.

CONCLUSIONS

Results of this trial indicate that relatively large volumes of chips ready for pulping can be produced from thinned and logged-over areas by portable debarking and chipping machines. Chip productivity rates are affected by material size, stand volume per acre, skidding conditions, and topography. When the volume of chipping material per area is relatively high, the material should be skidded into place and fed directly to the machines. When the volume is relatively low, the material should be skidded and decked before the machines are moved into the area.

To summarize, use of portable debarking and chipping machines on appropriate areas would:

1. Reduce the cost of intensive forestry practices;
2. Produce clean, usable chips;
3. Improve timber utilization, which would reduce wastage and fire hazard;
4. Reduce the total volume of slash, slash disposal costs, and air pollution resulting from the burning of slash;
5. Improve conditions that favor regeneration, either natural or artificial.